REMARKS

Claims 1-9 have been rejected under 35 U.S.C. 103 as unpatentable over Pillhoefer et al. U.S. Patent No. 6,120,843 in view of Benden et al. U.S. Patent No. 4,148,275 as indicated at the bottom of page 2 and at pages 3 and 4 of the patent Office Action. Applicants traverse this rejection and the grounds that U.S. Patent No. 6,120,843 to Pillhoefer et al. is only available as prior art under 35 U.S.C. 102(e) and, in accordance with 35 U.S.C. 103(c) a subject matter developed by another person which qualifies as prior art only under subsections (e), (f) and (g) of section 102 shall not preclude patentability where the subject matter and the claimed invention were, at the time, the invention was made, owned by the same person or subject to an obligation of assignment to the same person.

The present application as well as the reference to Pillhoefer et al. U.S. Patent No. 6,120,843 were both based on an employed-invention assigned onto MTU Aero Engines GmbH. The former name of MTU Aero Engines GmbH was MTU Motoren- UND Turbinen-Union München GmbH as indicated at No. 50 on the attached copy of the Official Register of Trading Companies related to MTU Aero Engines GmbH and was changed to MTU Aero Engines GmbH (See No. 57) on September 7, 2000. With respect to qualifying as prior art under 35 U.S.C. 102(a), Applicants submit that the Pillhoefer et al. reference was not patented or described in the printed publication before the invention of the present invention. The present application has a priority date of July 27, 2000 based on German Application 100 36 620.1-45 which proceeds the patenting date of September 19, 2000 for U.S. Patent

No. 6,120,843. In other to perfect this priority, Applicants are submitting herewith a certified translation of German Patent Application 100 36 620.1.

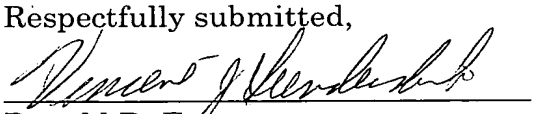
Therefore, as the reference to Pillhoefer et al. is only available as prior art under 35 U.S.C. 102(e) and because both Pillhoefer et al. and the present application were, at the time the invention was made, owned by the same person or subject to the obligation of assignment to the same person, Applicants respectfully request that this application containing claims 1-9 be allowed and be passed to issue.

If there are any questions regarding this amendment or the application in general, a telephone call to the undersigned would be appreciated since this should expedite the prosecution of the application for all concerned.

If necessary to effect a timely response, this paper should be considered as a petition for an Extension of Time sufficient to effect a timely response, and please charge any deficiency in fees or credit any overpayments to Deposit Account No. 05-1323 (Docket #038741.50233US).

October 29, 2003

Respectfully submitted,



Donald D. Evenson
Registration No. 26,160
Vincent J. Sunderdick
Registration No. 29,004

CROWELL & MORING, LLP
P.O. Box 14300
Washington, DC 20044-4300
Telephone No.: (202) 624-2500
Facsimile No.: (202) 628-8844

DDE:VJS:adb

TRANSLATOR'S DECLARATION

I, CHRISTA SCHAERTEL, declare and say:

1. That I reside at 413 South Fayette Street, Alexandria, Virginia 22314;

2. That I am thoroughly familiar with the German and English languages, holding a Translator's and Interpreter's Diploma from the Institute of Interpreting and Foreign Languages, Goettingen, Germany;

3. That I translated the Patent Application, File Number 100 36 620.1, with the title

cs. PROCESS DEVICE

~~METHOD~~ AND ~~PROCESS~~ FOR CHROMIZING AN INTERIOR SURFACE OF A COMPONENT

written in the German language; and

That the attached is a correct English translation of the above-mentioned German language document to the best of my knowledge and belief.

Christa Schaertel

Christa Schaertel

Date: 10/18/03

FEDERAL REPUBLIC OF GERMANY

Priority Certificate

Concerning the Filing of a Patent Application

File Number:	100 36 620.1
Filing Date:	July 27, 2000
Applicant/Holder:	MTU Aero Engines GmbH München/DE
Title:	Process and Device for Chromizing an Interior Surface of a Component
IPC:	C 23 C 10/12
Remark:	The applicant filed this patent application under the firm name: MTU MOTOREN- UND TURBINEN-UNION MÜNCHEN GMBH

The attached documents are correct and precise copies of the original documents of this patent application.

(Seal)

München, August 30, 2001

German Patent and Trademark Office

The President
By Order:
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P609 424

PROCESS AND DEVICE FOR CHROMIZING AN INTERIOR SURFACE OF A COMPONENT

The invention relates to a process and a device for chromizing an interior surface, particularly a cavity, of a metallic component.

For saving weight or for cooling, metallic components, such as turbine blades of industrial gas turbines or aircraft engines, may have a hollow construction and have a cavity with an interior surface. Because of the risk of corrosion or sulfidizing, the interior surface has to be chromized by sulfur in the case of turbine blades.

A so-called powder pack process is known for chromizing the interior surface of the cavity of turbine blades, in which a powder mixture consisting of Al_3O_2, chromium and an activator, such as NH_4Cl, is filled into the cavity. When heating the powder mixture while feeding hydrogen, chromium separates while forming a chromium-containing diffusion layer. A disadvantage of this process is the feeding and removing of the powder mixture into and from the cavity. During the feeding, the complete

covering of the interior surface of the cavity required for forming a closed diffusion layer presents problems, particularly in the case of complicated geometries or sharp edges. According to the process, the so-called powder pack is difficult to remove from the cavities without any residue. Powder residues frequently adhere to the interior surface of the cavity.

It is an object of the present invention to provide a process of the initially mentioned type, in which the interior surface to be coated does not have to be brought in contact with a powder forming the coating gas. Furthermore, a device for chromizing an interior surface of a component is to be created.

Concerning the process, the solution is characterized by

making available a mixture of chromium granulates and an activator;

heating the mixture to a temperature so that a coating gas is formed which comprises an essentially gaseous CrCl;

discharging the coating gas;

acting upon the interior surface of the component by means of the coating gas while forming a chromium-containing diffusion layer.

The advantage of the process consists of the fact that the coating of the interior surface of the cavity takes place in the

gaseous phase and, at the beginning of the process, the feeding of a powder mixture as well as, after the implementation of the coating, the removal of the powder pack is eliminated. In addition no remnants of power residue can adhere to the coated surface of the cavity. The mixture, which essentially consists of granulates, for example, having a particle size of from 5 - 20 mm, can be processed more rapidly and economically than a power mixture consisting of a dispenser powder and a filling powder for preventing a sintering. The granulates do not cause any clogging which could hinder the discharging of the coating gas. In addition, the granulates are degraded successively and do not have to be exchanged after each coating process, like a powder.

The mixture may be made available with approximately 99% by weight chromium granulates and approximately 1% by weight activator, in which case, for example, a powdery NH_4Cl can be provided, as the activator.

For forming the coating gas, the mixture can be heated to a temperature of approximately 1,200°C.

The discharging of the coating gas from the vessel and the acting upon the interior surface of the component to be coated can take place automatically under the effect of the force of gravity because the coating gas comprising essentially CrCl has a

higher density or specific gravity than the gases of the environment, such as the inert gas. By means of the heating, coating gas is therefore produced continuously without the requirement of further measures for generating or influencing the flow.

The process can be carried out in an inert environment, in which, for example, Ar is used for the sweeping.

As a component, a hollow turbine blade can be provided whose cavity is used for saving weight or for cooling and whose surface has to be protected against corrosion and/or sulfidizing. The latter occurs particularly in the case of hollow uncooled gas turbine components.

In order to ensure a reliable protection against corrosion and sulfidizing, the diffusion layer is formed with a layer thickness in the range of 25 μm and a chromium content in the range of from 17% to 20%.

Furthermore, according to the invention, the solution is characterized by a device with a vessel for receiving a mixture of chromium granulates and an activator, such as powdery NH_4Cl, in whose bottom at least one outlet is provided for a coating gas; and a mechanism for holding the component such that the

outlet of the vessel is positioned in the area of the interior surface of the component, the device being arrangeable in a heatable retort for heating the mixture situated in the vessel to such a temperature that a coating gas is formed which essentially comprises CrCl.

In order to ensure an advantageous discharge of the coating gas, the bottom of the container can extend in a diagonally sloping-down manner toward the outlet or can, for example, also be constructed in a funnel shape.

Furthermore, the shape of the outlet can be adapted to the shape of a cavity of the component having the interior surface, in order to ensure a complete and loss-free action upon the interior surface by the coating gas.

For creating an inert environment, the retort can have a gas feeding and a gas removing device for an inert gas, such as Ar, which is fed for sweeping the device and is discharged again.

Particularly for longer coating times, for which the powdery activator, such as NH_4Cl, which is initially present in the mixture, is not sufficient, the vessel may have a feeding tube for a powdery or particularly also gaseous activator, through which, for example, a mixture of HCl and Ar can be guided,

whereby additional coating gas is formed which essentially comprises CrCl.

For improving the efficiency, a large number of devices can be arranged in the retort in order to permit the simultaneous coating of several components. For this purpose, the device can also have several outlets at the bottom.

Additional embodiments of the invention are described in the subclaims.

In the following, the invention will be explained in detail by means of embodiments with reference to a drawing.

Figure 1 is a schematic lateral view of a device by means of which a cavity of a component can be gas-phase-chromized; and

Figure 2 is a schematic lateral view of an alternative embodiment of the vessel of the device of Figure 1.

Figure 1 is a schematic view of a device by means of which an interior surface 3 of a cavity 2 of a metallic component 1 can be chromized. The metallic component 1 is constructed as a turbine blade which has a cavity 2 with an interior surface 3. The mixture 4 of chromium granulates and NH_4Cl as the powdery

activator, which forms the later coating gas, is fed into a vessel 5 of the device and there fills approximately half the volume of the vessel 5, which amounts, for example, to approximately 8 to 10 l, as illustrated by the dotted line representing the mixture 4. At the bottom 6 of the vessel 5, an outlet 7 is provided through which a coating gas indicated by means of arrows 8 is discharged from the vessel 5 during the gas-phase-chromizing. For the simultaneous coating of several (incomplete sentence - translator)

The mixture 4 consists of approximately 99% by weight of chromium granulates with a particle size of between 5 - 20 mm and approximately 1% by weight of the powdery activator. The device is inserted into a retort 14 and, for creating an inert environment, is swept with 1,000 l/h Ar. Cavities exist between the particles of the granulates.

In a holding mechanism (not shown), the turbine blade 1 is positioned such that the outlet 7 of the vessel 5 is arranged in the area of an opening 9 of the cavity 2 of the turbine blade 1. In the embodiment, the shape of the outlet 7 is adapted to the opening 9 to the cavity 2 such that the outlet 7 projects into the cavity 2 and thus ensures an optimal flowing of the coating gas 8 through the cavity 2 or an action upon the interior surface 3 of the turbine blade 1 by means of the coating gas. The retort

14 has a heater (not shown) by means of which the mixture 4 in the vessel 5 is heated to such a temperature that the coating gas 8 is formed which essentially comprises CrCl.

Figure 1 also shows a gas feeding device 10 by means of which, as indicated by the arrows, an inert gas, such as Ar, is fed, by means of which the entire device is swept for creating an inert environment in the retort 14. As indicated by means of an arrow, the inert gas is continuously discharged by way a device 11.

In the case of the process for gas-phase-chromizing, the mixture 4 of chromium granulates and NH_4Cl as the activator provided in the vessel 5 is heated by means of a heater to a temperature of approximately 1,200°C, so that a coating gas is formed which comprises essentially gaseous CrCl. The coating gas 8 has a greater density or specific weight than the surrounding Ar or H_2 and, because of the effect of the force of gravity, automatically and continuously flows through the outlet 7 at the bottom 6 of the vessel 5; is guided in this manner to the cavity 2 of the turbine blade 1; and there acts upon its surface 2 while forming a chromium-containing diffusion layer, which is indicated in Figure 1 by means of a dotted line.

Because of the continuously forming coating gas 8 which

flows downward as a result of the force of gravity through the outlet 7, the described process takes place automatically. The coating temperature is held for a time period which can be varied as a function of the desired layer thickness. In the present embodiment of the process, the coating temperature is held for 10 hours. In this case, a chromium-containing diffusion layer 12 is formed which has a layer thickness of 25 μm and a chromium content of 17%.

Liquid CrCl, which is illustrated by a thick line marked 13, can deposit on the bottom 6 of the vessel 5.

Figure 2 is a schematic view of an alternative embodiment of the device, in which only a modified vessel 5' is illustrated. Here also, a mixture 4 consisting of chromium granulates and an activator, such as NH_4Cl, is fed into the vessel 5', the mixture 4 consisting, for example, of approximately 99% by weight chromium granulates and approximately 1% by weight NH_4Cl.

The modification of the vessel 5' consists of a funnel-shaped bottom 6' which slopes down toward the outlet 7 provided in the center of the funnel. In the same manner as in the embodiment illustrated in Figure 1, the coating gas indicated by the arrow 8, after the heating of the mixture 4 to the coating

temperature of approximately 1,100°C, flows through the outlet 7 and is guided in this manner for acting upon the interior surface of the metallic component into its cavity. Because of the funnel-shaped construction of the bottom 6', the gaseous CrCl as well as the possibly forming liquid CrCl can be discharged better through the outlet 7 or can flow off, can also reach the cavity and its interior surface and promote the forming of a chromium-containing diffusion layer.

For the simultaneous coating of several components 1, the vessels 5 illustrated in Figures 1 and 2 can each have several outlets 7 on the bottom 6. Likewise, several devices can be installed in a retort 14 for this purpose.

CLAIMS:

1. Process for chromizing an interior surface of a component
characterized by

providing a mixture (4) of chromium granulates and an activator,

heating the mixture (4) to such a temperature that a coating gas is formed which comprises an essentially gaseous CrCl,

discharging the coating gas,

acting upon the interior surface (3) of the component (1) by means of the coating gas while forming a chromium-containing diffusion layer.

2. Process according to Claim 1,
characterized in that the mixture (4) is provided with approximately 99% by weight chromium granulates and approximately 1% by weight activator.

3. Process according to Claim 1 or 2,
characterized in that NH_4Cl or HCL is provided as the activator.

4. Process according to one or more of the preceding claims,

characterized in that the mixture (4) is heated to a temperature of approximately 1,200°C.

5. Process according to one or more of the preceding claims,
characterized in that the discharging of the coating gas and the action upon the interior surface (3) of the component (1) takes place automatically under the effect of the force of gravity.

6. Process according to one or more of the preceding claims,
characterized by an implementation in an inert environment.

7. Process according to one or more of the preceding claims,
characterized in that a hollow turbine blade is provided as the component (1).

8. Process according to one or more of the preceding claims,
characterized in that the diffusion layer is formed with a layer thickness in the range of 25 μm.

9. Process according to one or more of the preceding claims,

characterized in that the diffusion layer is formed with a chromium content in the range of from 17% to 20%.

10. Device for chromizing an interior surface of a component, having a vessel (5) for accommodating a mixture (4) of chromium granulates and an activator, at whose bottom (6) a least one outlet (7) for a coating gas (8) is provided, and having a mechanism for holding the component (1) so that, the outlet of the vessel (5) is positioned in the area of the interior surface (3) of the component (1), the device being arrangeable in a heatable retort (4) for the heating of the mixture (4) situated in the vessel (5) to such a temperature that a coating gas is formed which comprises essentially CrCl.

11. Device according to Claim 10,
characterized in that the bottom (6) extends in a sloping-down manner toward the outlet (7).

12. Device according to Claim 10 or 11,
characterized in that the bottom (6) has a funnel-shaped construction and slopes down toward the outlet (7).

13. Device according to one or more of Claims 10 to 12, characterized in that the shape of the outlet (7) is adapted to the shape of a cavity (2) of the component (1) which has the

interior surface (3).

14. Device according to one or more of Claims 10 to 13, characterized in that the device can be arranged in a retort (14) with a gas feeding and gas removing device (10 and 11 respectively) for creating an inert environment.

15. Device according to one or more of Claims 10 to 14, characterized by a feeding tube (10) for a powdery or gaseous activator into the vessel (5).

16. Device according to one or more of Claims 10 to 15, characterized in that a plurality of devices can be arranged in the retort (14).

ABSTRACT:

A process and a device for chromizing an interior surface of a component, in which the interior surface to be coated is not brought in contact with a powder forming the coating gas, with the steps of: Providing a mixture (4) of chromium granulates and an activator; heating the mixture (4) to such a temperature that a coating gas is formed which comprises an essentially gaseous CrCl; discharging the coating gas; and acting upon the interior surface (3) of the component (1) by means of the coating gas while forming a chromium-containing diffusion layer (Figure 1).

Amtsgericht München

Blatt 7

HR B 1035

Nr. der Eintragung	a) Firma b) Sitz c) Gegenstand des Unternehmens	Grund- oder Stammkapital DM	Vorstand Persönlich haftende Gesellschafter Geschäftsführer Abwickler	Prokura	Rechtsverhältnisse	a) Tag der Eintragung und Unterschrift b) Bemerkungen
1	2	3	4	5	6	7
~~53~~ 50	a) MTU Motoren- und Turbinen-Union München Gesellschaft mit beschränkter Haftung b) München c) Entwicklung, Herstellung und Vertrieb von Verbrennungskraftmaschinen (insbesondere Gasturbinen und Motoren) und Getrieben sowie deren Regelungs- und Überwachungseinrichtungen einschließlich deren Zubehör und Ersatzteilen für Land-, Luft- und Wasserfahrzeuge sowie für stationäre Verwendung	156.600.000	Hertrich Rainer, Diplom-Kaufmann in München Liebau Bernd, Industriekaufmann in Clairton, U.S.A. Dr. Steffens Klaus, Diplom-Ingenieur in Aachen	Prokura zusammen mit einem Geschäftsführer oder einem anderen Prokuristen: 1) Dr. Lück Dirk, Stuttgart; 2) Schnabel Manfred, Mosbach/Baden ; 3) Steinberger Martin, München ; 4) von Gizycki Michael, München.	GmbH mit Gesellschaftsvertrag vom 22. Juni 1934, zuletzt geändert mit Beschluß vom 29. September 1995. Die Gesellschaft hat mindestens zwei Geschäftsführer. Sie wird entweder durch zwei Geschäftsführer oder durch einen Geschäftsführer zusammen mit einem Prokuristen vertreten. Die Gesellschaft hat am 27. Oktober 1992 mit der "Deutsche Aerospace Aktiengesellschaft" (früher: "Messerschmitt-Bölkow-Blohm Aktiengesellschaft") mit dem Sitz in München (AG München, HRB 98454) als herrschender Gesellschaft einen Beherrschungs- und Gewinnabführungsvertrag geschlossen. Die Gesellschafterversammlung hat mit Beschluß vom 29., Oktober 1992 zugestimmt.	a)22.5.1997 Re b) Zusammenfassung der Einträge 1 - 49; Satzung Bl. 665 SB Vertrag und Zustimmungsbeschluß Bl. 626, 626 SB
51				Prokura zusammen mit einem Geschäftsführer oder einem anderen Prokuristen 5) Baciulis Rainer, Merzig.		a)~~1.10~~.1997 Pa
52			Uebber Bodo, Dipl.-Wirtsch.-Ing. in München	Prokura erloschen: 2) Schnabel Manfred.	Liebau Bernd ist nicht mehr Geschäftsführer. Zum Geschäftsführer ist bestellt: Uebber Bodo, Dipl.-Wirtsch.-Ing. in München.	a)13.5.1998 Posch Posch

Amtsgericht München

Rückseite von Blatt 1

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Nr. der Eintragung	a) Firma b) Sitz c) Gegenstand des Unternehmens	Grund- oder Stammkapital DM	Vorstand Persönlich haftende Gesellschafter Geschäftsführer Abwickler	Prokura	Rechtsverhältnisse	a) Tag der Eintragung und Unterschrift b) Bemerkungen
1	2	3	4	5	6	7
53					Die Gesellschafterversammlung vom 11. Juni 1999 hat die Änderung des § 4 (Geschäftsjahr) der Satzung beschlossen.	a)23.6.1999 Posch Posch b) Beschluß Bl. 699 SB Neue Satzung Bl. 700 SB
54				Prokura erloschen: 3) Steinberger Martin; 4) von Gizycki Michael. Prokura zusammen mit einem Geschäftsführer oder einem anderen Prokuristen: 6) Pfingstgraef Heinz, Moosburg, geb. 29.05.1940; 7) Weber Michael, München, geb. 18.08.1963.		a)21.10.1999 Posch Posch
55					Die Gesellschafterversammlung vom 16. November 1999 hat die Änderung des § 4 (Geschäftsjahr) der Satzung beschlossen.	a)25.11.1999 Posch Posch b) Beschluß Bl. 710 SB Neue Satzung Bl. 711 SB

Fortsetzung auf dem 2 ten Blatt

Amtsgericht München

Blatt 2

HR B 1035

Nr. der Eintragung	a) Firma b) Sitz c) Gegenstand des Unternehmens	Grund- oder Stammkapital DM	Vorstand Persönlich haftende Gesellschafter Geschäftsführer Abwickler	Prokura	Rechtsverhältnisse	a) Tag der Eintragung und Unterschrift b) Bemerkungen
1	2	3	4	5	6	7
56			Dr. Lück Dirk, München, geb. 24.06.1941	Prokura erloschen: 1) Dr. Lück Dirk.	Hertrich Rainer ist nicht mehr Geschäftsführer. Zum Geschäftsführer ist bestellt: Dr. Lück Dirk, München, geb. 24.06.1941.	a)10.4.2000 Ranz
57	a) MTU Aero Engines GmbH				Die Gesellschafterversammlung vom 07. September 2000 hat die Änderung des § 1 (Firma) der Satzung beschlossen.	a)18.9.2000 Posch b) Beschluß Bl. 755 SB Neue Satzung Bl. 756 SB
58					Die DaimlerChrysler Luft- und Raumfahrt Holding Aktiengesellschaft mit Sitz in München (AG München, HRA 91671) ist dem Beherrschungs- und Gewinnabführungsvertrag zwischen der DaimlerChrysler Aerospace Aktiengesellschaft (früher: "Deutsche Aerospace Aktiengesellschaft") mit Sitz in Ottobrunn und der MTU Aero Engines GmbH mit Sitz in München vom 27. Oktober 1992 als weiteres herrschendes Unternehmen mit Vereinbarung vom 21. Dezember 2000 beigetreten. Der Beherrschungs- und Gewinnabführungsvertrag wurde neu gefaßt. Die Gesellschafterversammlung der beteiligten Gesellschaften haben dem Beitritt und der Vertragsneufassung am 21. Dezember 2000 zugestimmt.	a)1.2.2001 Scharl b) Vertrag Bl. 759 SB Beschlüsse Bl. 759, 760, 761 SB Richtig: HRB

Amtsgericht München

Rückseite von Blatt 2

HR B 1035

Nr. der Eintragung	a) Firma b) Sitz c) Gegenstand des Unternehmens	Grund- oder Stammkapital DM	Vorstand Persönlich haftende Gesellschafter Geschäftsführer Abwickler	Prokura	Rechtsverhältnisse	a) Tag der Eintragung und Unterschrift b) Bemerkungen
1	2	3	4	5	6	7
59				Prokura zusammen mit einem Geschäftsführer oder einem anderen Prokuristen: 8) Dr. Krammer Paul, Gilching, geb. 08.01.1953; 9) Grall Paul Egon, Mellendorf, geb. 02.11.1944.		a)28.3.2001 Posch Posch

Fortsetzung auf dem ___ten Blatt

DIE ÜBEREINSTIMMUNG DIESER PHOTOKOPIE MIT DEM HANDELSREGISTER WIRD BEGLAUBIGT:

Rotunterstreichungen erscheinen in der Photokopie schwarz, aus phototechnischen Gründen nur undeutlich oder überhaupt nicht.

Amtsgericht -Registergericht- München, den 23. Okt. 01

Lewey
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Urkundsbeamter der Geschäftsstelle